Renal Artery Stenosis

Treatment: When, How, and by Whom

RAS : Pathology

- Atherosclerotic (66%)
- Fibromuscular Dysplasia (30%)
  - 5 subtypes (medial fibroplasia 60-70%)
- Restenotic
- Neurofibromatosis
- Abdominal coarctation
- Primary vasculitis

RAS : Incidence

- Depends on the patient population
- In patients going for cardiac cath with HTN: 20-30%
- In patients going for cardiac cath with HTN and CRI : 30-50%
- In patients starting hemodialysis: 14%
- In pts with PVD: 40-60% (13% bilateral)

Scoble et al. Clin Nephrol. 1989;31:119

Olin et al. AJM 1990

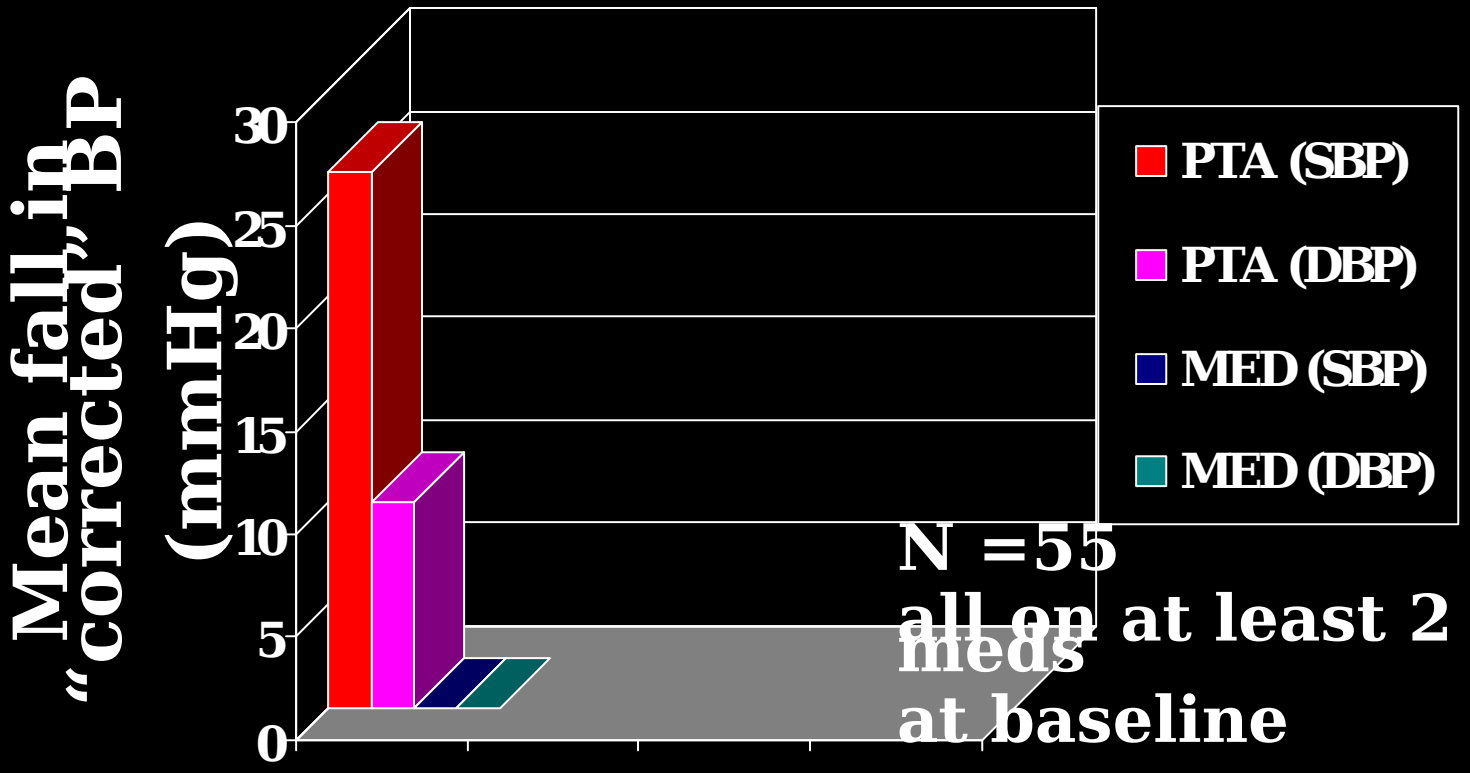
RAS : **The Big Questions**

- Does RAS ever benefit from revascularization?
- How do we diagnose “clinically important” RAS?
- What are the safety and efficacy profiles of different revascularization or medical therapies?

RAS Revascularization : Who has Benefited

- Renovascular Hypertension (RVH)
- Ischemic Nephropathy
- Congestive Heart Failure
- Unstable Angina

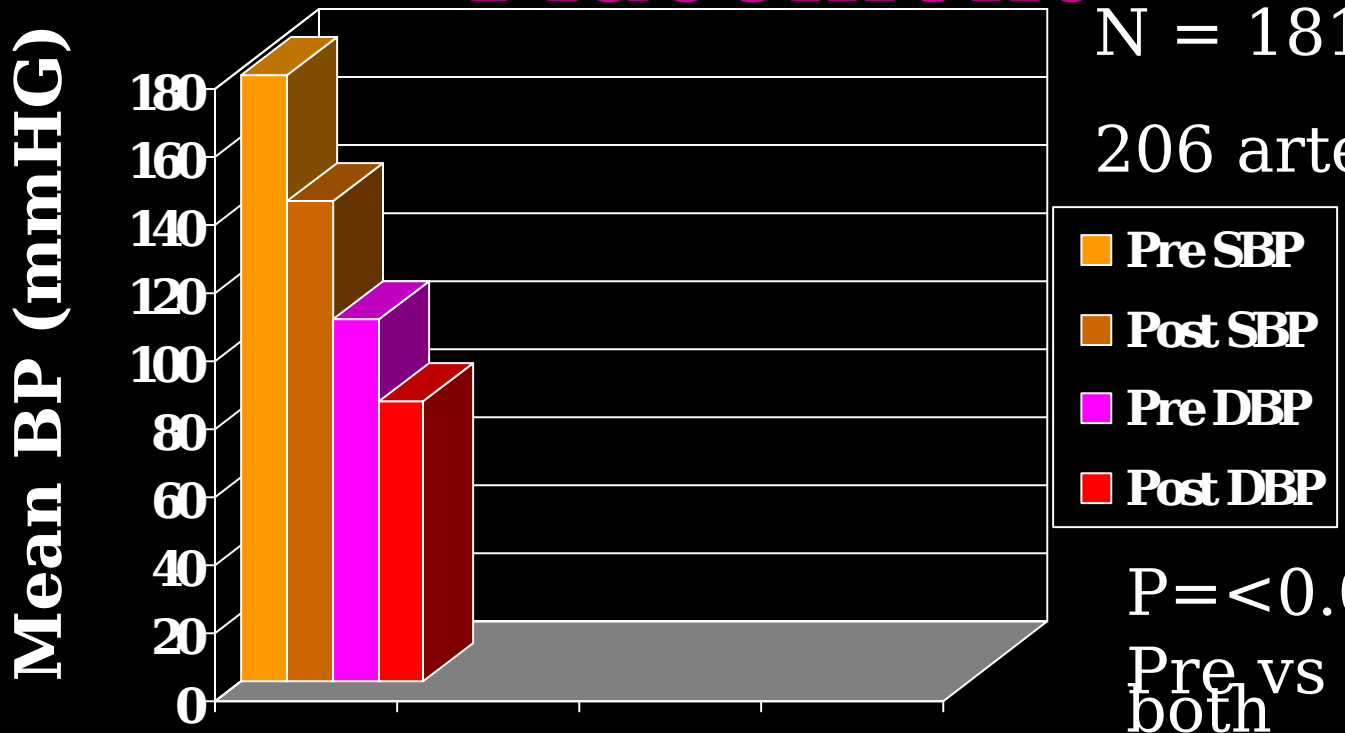
RAS: RCT of PTA vs Meds for RVHTN



P= <0.05 for PTA vs Med (only for bilateral ras)

Webster, et al. J Hum Hypertens 1998;12:329

RAS: 7yr cohort f/u after Renal PTA/Stent Placement



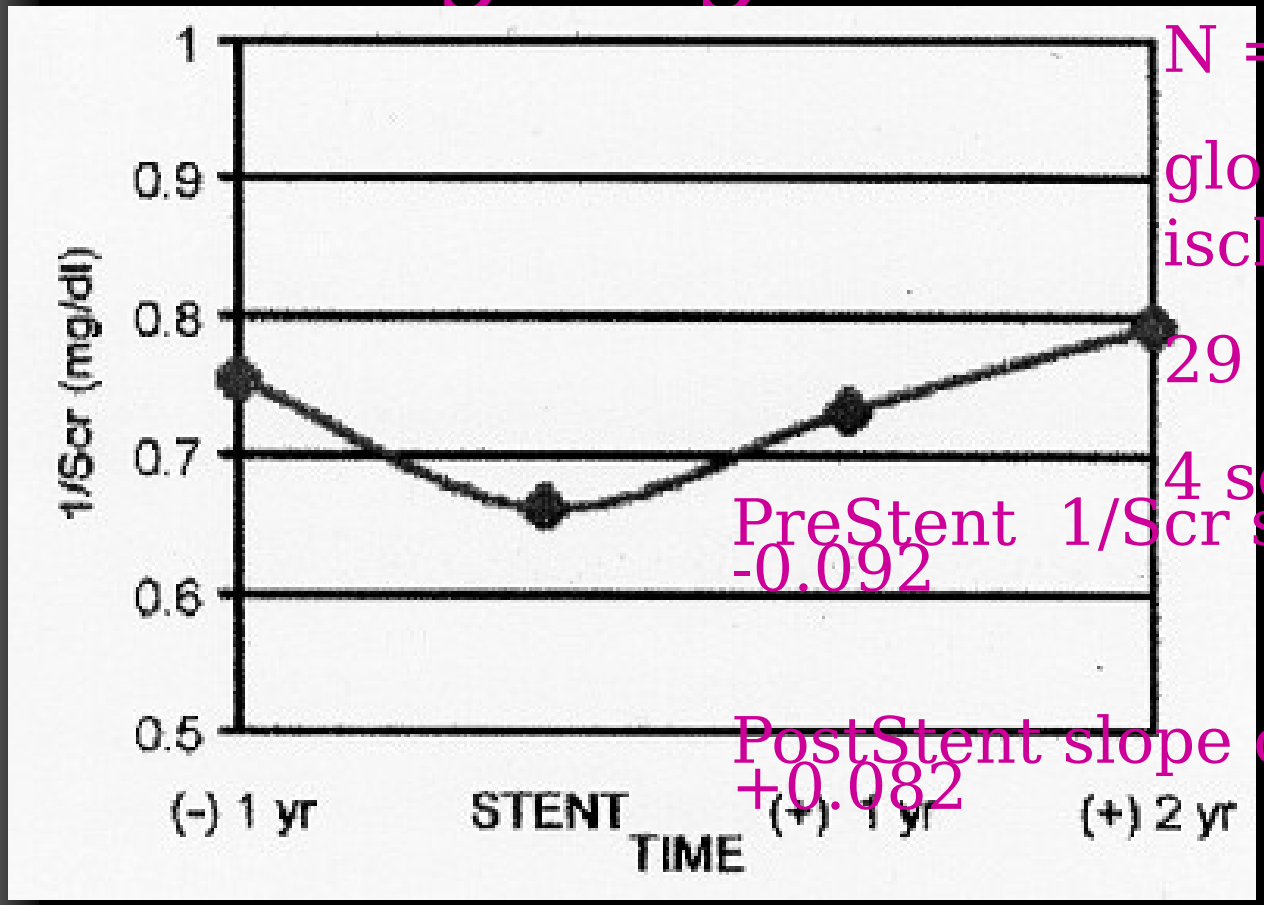
N = 181pts,

206 arteries

P=<0.05 for Pre vs Post in both SBP and DBP

Henry, et al. JACC 1998;31:453A

RAS: Cohort with CRI undergoing renal



N = 33pts with

global renal ischemia

29 bilateral RAS

4 solitary kidney

PreStent 1/Scr slope= -0.092

p= <0.003

PostStent slope over 2yrs = +0.082

p=<0.012

Ahuja, et al. JACC 1999;33:42A

RAS : Indications for Revascularization

(1) RVHTN poorly controlled on medical tx

(2) Ischemic nephropathy : progressive renal insufficiency or loss of renal mass.

(3) CHF : difficult to manage with medical tx associated with bilateral RAS or unilateral RAS to single functioning kidney.

Jaff, et al. Tex Heart Inst J 1998;25:34

RAS : The Big Questions

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How does one diagnose "Clinically Important" RAS

- Gold Standard ?: Clinical improvement after revascularization.
  - Improvement in HTN.
  - Improvement in renal function or prevention of deterioration.
  - Improvement in CHF symptoms.

Determination of Clinically Important RAS before Revascularization

- Best predicted by both 1) & 2).

1) A hemodynamically significant lesion

2) Clinical consequence of RAS :

"presence of a clinical indication for revascularization"

What is a hemodynamically significant RAS lesion

- Anatomy and Physiology
  - %DS >50% with physiologic evidence of poor distal flow._
- Invasive methods: for physiology
  - >20mmHg gradient across lesion
  - angiographic collaterls / Renal vein renins
- Non-Invasive methods: for physiology
  - Duplex US (RAR >3.5)
  - Captopril Renography (20min/max >0.3)
  - differential renal size.

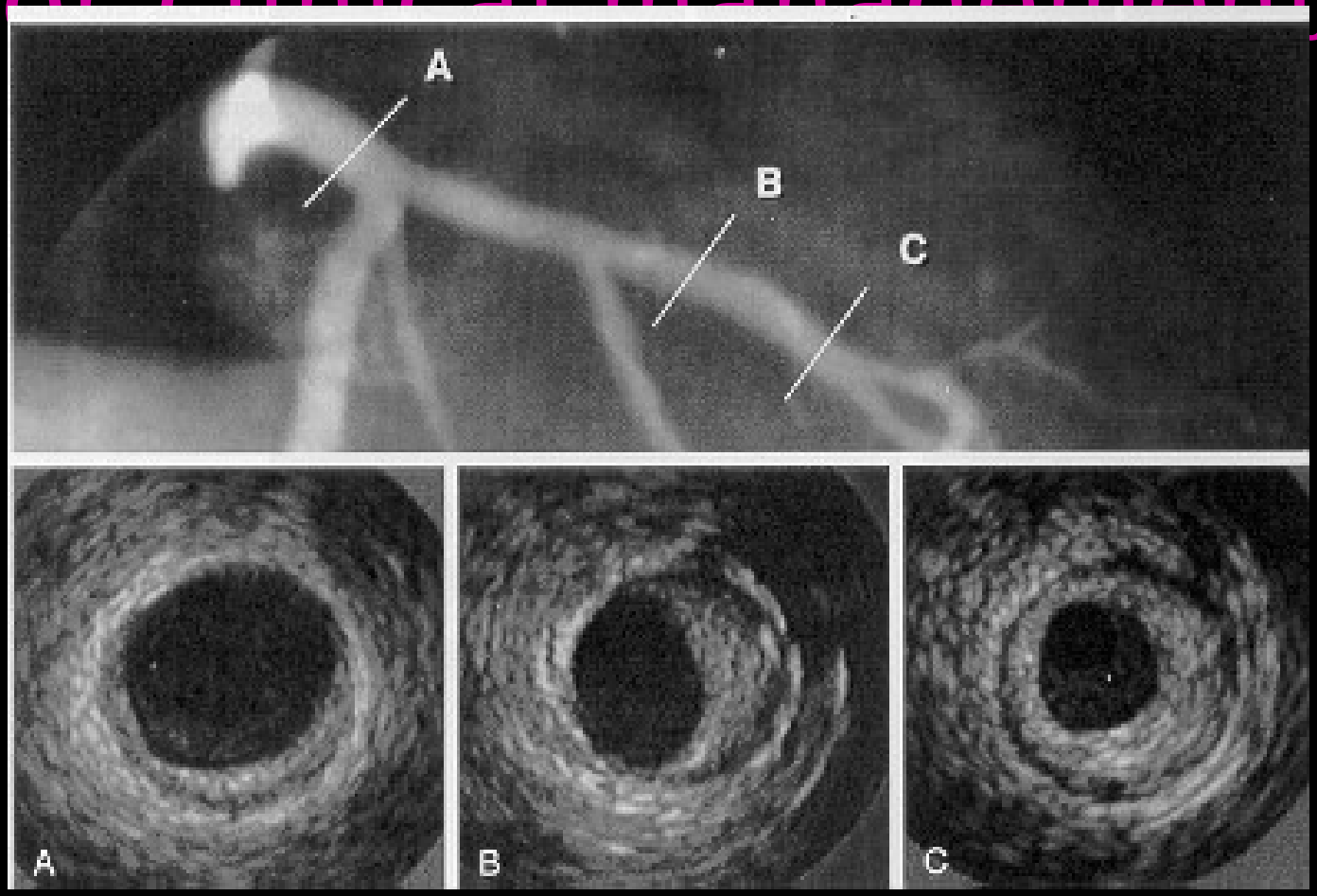
Physiologic Tests for RAS

- WARNING !
  - Most tests were designed to evaluate for RVHTN and not for Ischemic Nephropathy.
  - Limitations in evaluating ischemic nephropathy vary from test to test.

What is a hemodynamically significant RAS lesion

- Anatomy plus Physiology
- Test for Anatomic lesion severity:
  - IVUS (?gold standard)
  - Contrast / CO2 / or Subtraction angiography
  - Duplex US
  - MRA
  - Spiral CT

Why is the angiographic % DS “alone” not good enough for clinical management?



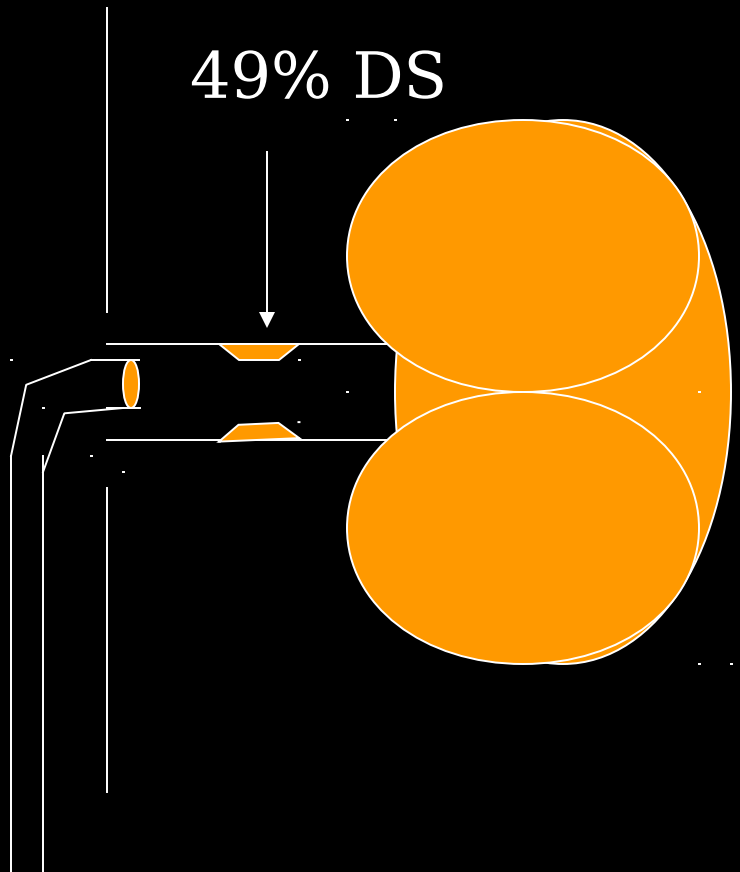
Is the method of determining a gradient across a renal artery lesion important?

REF MLD= 6.0mm

Lesion MLD= 3.0mm

8F catheter = 2.7mm dia.

6F catheter = 2.0mm dia.



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RCT for the Treatment of RAS

- 1) Weibull et al : PTA vs Surgery
- 2) Webster et al : PTA vs Medicine
- 3) Plouin et al : PTA vs Medicine
- 4)
- 5)
- 6)
- 7)

RAS: RCT of PTA VS. Surgery

58 patients with unilateral RAS (lesion < 1cm from Aorta), positive renal vein renins and severe HTN randomized to PTA (no stents) or Surgery :

Routine angiographic f/u at 2yrs.

	PTA	Surgery	p-value
technical success	83%	97%	0.19
2yr primary patency*	75%	96%	0.05
2yr secondary patency**	90%	97%	0.61
HTN cured/improve NS	**90%**	**86%**	

*patency =<50% DS at f/u

** secondary patency = “one” additional

Weibull, et al. J Vasc Surg 1993;18:841

RAS: RCT -PTA VS. Surgery (2)

Development of contralateral RAS at 2yrs = 14%

Procedural complications

	PTA	Surgery	p-value
Mortality	0%	0%	
Major complication	17%	31%	NS
Minor	48%	7%	NS

Weibull, et al, J Vasc Surg 1993;18:841

RAS: Acute and Late complications of revascularization

- Acute complications: (favor PTA)
  - death, emergent surgery, ARF requiring dialysis.
- Late complications: (? favor surgery)
  - graft failure/thrombosis
  - post pta/stent restenosis
- Restenosis: angiographic or clinical
  - DS as categorical (binary), DS as continuous variable, late loss index, or TVR.

Surgery and PTA/Stent for RAS: reported success and complications

	N	technical success	major peri-procedural comp*	death	
Stent White, et al.1998	100	99%	1%	0%	
Stent Mendelsohn, et al. 1999	300	100%	0%	0%	
Stent Dorros, et al. 1998	163	99%	0%	1%	
Surgery Hansen, et al. 1992		99%	17%	3% **	200
Surgery Hallett, et al. 1987			7%		98

IVUS guided PTA/Stent of RAS at WRAMC : 1997-1999

N = 12 patients , mean clinical f/u 13 months (range 6-19mon)

33% ostial, 58% proximal RAS; (IN/RVHTN 7/12, IN 5/12)

IVUS guided stent placement in 66%

F/U: Angiographic or duplex ultrasound

Procedure Success	Comp./ Restenosis TVR Morbidity	Mortality at 30d	at F/U
100%	1/12 (8%)*	0%	0% 0%

RAS PTA: Ostial vs. NonOstial: is there a difference in results ?

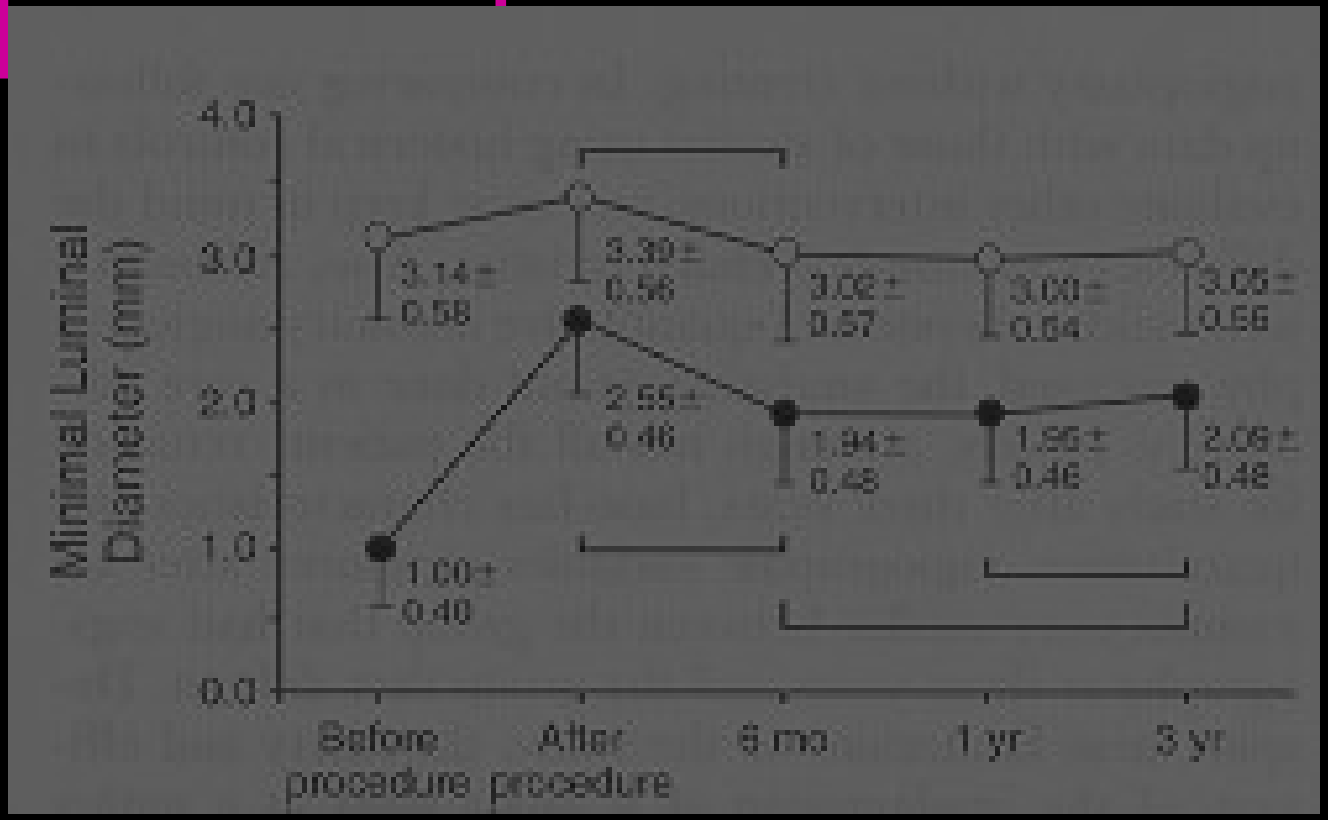
7yr F/U of 181 patients (206 renal arteries) treated with Palmaz and AVE Stents

7yr	primary patency	secondary patency
Ostial	80% *	93%
NonOstial	78% *	100%

*p=NS

Henry, et al. JACC 1998;31:453A

3yr Angiographic F/U of Lumen Size after Stent Pl



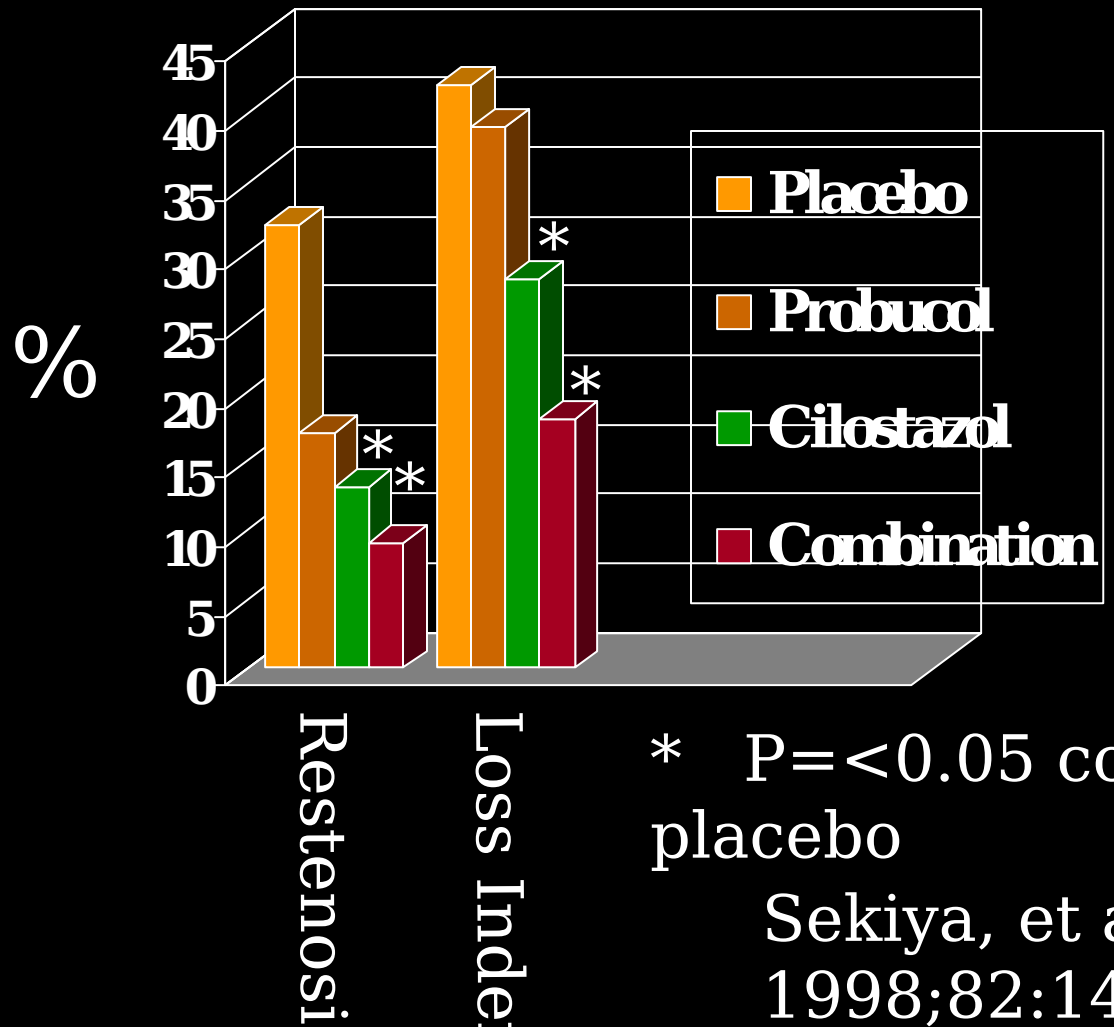
Kimura, et al. NEJM 1996;334:561

New techniques and Rx that may decrease restenosis after PTA

- IVUS: post MLD most important predictor of restenosis. IVUS guidance portends a greater MLD post procedure.

- New Rx / Tx to prevent resentosis : NIH and negative remodeling.
  - Probucol
  - Cilostazol
  - Molsidomine
  - radiation therapy

Effect of Cilostazol on Restenosis



Randomized trial

N=136 patients

6month angiographic f/u after coronary stent placed.

* P=<0.05 compared to placebo

Sekiya, et al. AJC 1998;82:144

When to pursue a workup for hemodynamically significant RAS

1) When there is an indication for revascularization

AND

2) JNC VI clinical clues present in a patient with HTN or CHF

OR

Ischemic nephropathy suspected (elevated creatinine or tissue loss w/out obvious cause)

Joint National Committee (JNC VI) for evaluation/tx for hypertension : clinical clues for RAS

1) Onset of HTN < age 30 or > age 55
2) Abdominal bruit
3) Accelerated or resistant HTN
4) Recurrent (flash) CHF
5) Renal failure of uncertain etiology
6) Coexisting diffuse PVOD, especially heavy smokers
7) Acute renal failure precipitated by ACE inhibitor or AT-II receptor blocker therapy